Morecambe Offshore Windfarm: Generation Assets

Examination Documents

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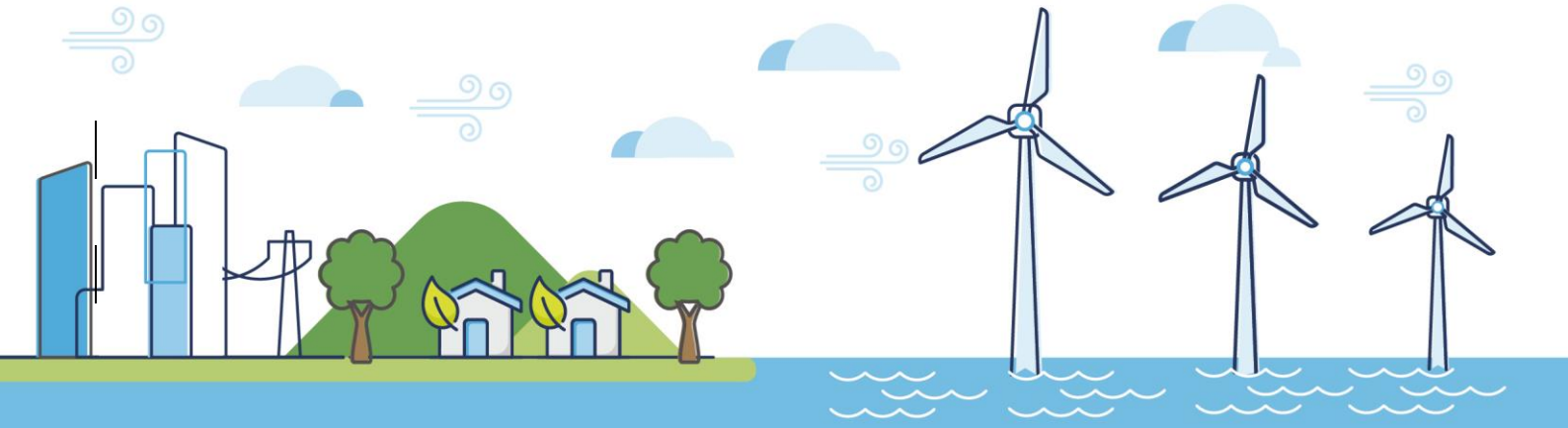

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02	22 January 2025	Approved for Use	Royal HaskoningDHV	Morecambe Offshore Windfarm Ltd	Morecambe Offshore Windfarm Ltd	Updates following NRW D1 submission

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Glossary of Acronyms

AON	Apparently Occupied Nests
AR	Avoidance Rate
BDMPS	Biologically Defined Minimum Population Scales
CEA	Cumulative Effect Assessment
CPGR	Counterfactual of Population Growth Rate
CPS	Counterfactual of Population Size
CRM	Collision Risk Model
DCO	Development Consent Order
EIA	Environmental Impact Assessment
ES	Environmental Statement
ExA	Examining Authority
HAT	Highest Astronomical Tide
LBBG	Lesser black-backed gull
LCL	Lower Confidence Limit
MERP	Marine Ecosystems Research Programme
OWF	Offshore windfarm
PVA	Population Viability Analysis
RIAA	Report to Inform the Appropriate Assessment
RR	Relevant Representation
sCRM	Stochastic Collision Risk Model
SD	Standard deviation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
TCE	The Crown Estate
UCL	Upper Confidence Limit

Glossary of Unit Terms

km	Kilometre
km^2	square kilometre
m	metre

Glossary of Terminology

Applicant	Morecambe Offshore Windfarm Ltd
Biologically defined minimum population scale (BDMPS)	The estimated population size of a species within a defined biogeographic area during a biologically relevant season, as defined by Furness (2015). For many seabird species present in United Kingdom (UK) waters there are two defined biogeographic areas; UK Western waters and UK North Sea and Channel. However, some species have different defined BDMPS areas, dependent on the distribution and movements of the species population through the year. Furness (2015) defines the BDMPS for non-breeding seasons; the breeding season BDMPS is defined as the breeding population within foraging range from the project, plus non-breeders and immatures.
Generation Assets (the Project)	Generation Assets associated with the Morecambe Offshore Windfarm. This is infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators (WTGs), inter-array cables, offshore substation platform(s) (OSP(s)) and possible platform link cables to connect OSP(s).
Inter-array cables	Cables which link the WTGs to each other and the OSP(s).
Offshore substation platform(s) (OSP(s))	A fixed structure located within the windfarm site, containing electrical equipment to aggregate the power from the WTGs and convert it into a more suitable form for export to shore.
Platform link cable	An electrical cable which links one or more offshore substation platform.
Stochastic Collision Risk Model (sCRM)	A programme used to assess the collision risk (estimated mortality) of seabirds to operational turbines of offshore windfarms. A sCRM is used to account for uncertainty around input variables.
Wind turbine generator (WTG)	A fixed structure located within the windfarm site that converts the kinetic energy of wind into electrical energy.
Windfarm site	The area within which the WTGs, inter-array cables, OSP(s) and platform link cables would be present.

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1 Introduction

1. This document presents an update to the Report to Inform the Appropriate Assessment (RIAA) (~~APP-027~~REP1-012) submitted as part of the assessment of the Morecambe Offshore Windfarm Generation Assets on offshore ornithology receptors.

2. The Applicant's response to Relevant Representations (RRs) was provided at Procedural Deadline A (PD1-011). The review and information provided in this note has been undertaken to provide information on outstanding issues from the Natural England Relevant Representations (RR-061) and at the request of the Examining Authority (ExA) in its Rule 9 Letter (PD-006) and Rule 8 Letter (PD-010). In addition, updates have been provided to address specific comments from Natural Resources Wales (NRW) in its written representations at Deadline 1 (REP1-099). A summary of the relevant comments received and the Applicant's response, including where specific items are addressed within this document, are provided in **Table 1.1**~~**Table 1.1Table 1.1**~~. (Natural England) and **Table 1.2**~~**Table 1.2Table 1.2**~~ (NRW).

1.1 Updates at Deadline 3

3. The following updates to this document (Rev 02) have been included at Deadline 3:

- Updated assessment of operational displacement on Manx shearwater from the Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island Special Protection Area (SPA) (**Section 3.1**) and Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA (**Section 3.2**) to reflect updated seasonal periods for this species, as advised by NRW in its written representations (REP1-099).
- Updated assessment of displacement and collision risk on gannet from Grassholm SPA to reflect updated seasonal periods for this species, as advised by Natural England in its Relevant Representations (RR-061) and NRW in its written representations (REP1-099) (**Section 3.3**).
- Updates to Examination document references, as appropriate.

Table 1.1 Summary of Natural England relevant representations addressed in this document

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
In-combination assessment methodology. NE has requested that historic projects with 'zero' values are 'gap-filled' using a common approach with the Mona and Morgan projects. NE requested that this was specifically addressed for lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA, which are the only sites where Natural England disagreed with the Applicant's in-combination conclusions and data was not presented for one historic project (Robin Rigg).	B1 B3 (Item 1 of the Rule 9 letter)	RR-061-63 RR-061-65	The in-combination assessment for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA) has been updated with data for Robin Rigg offshore windfarm, and also to align with data presented by the Mona Offshore Wind and Morgan Generation Offshore Wind projects.	**Section 3**
NE requested that 2023 colony counts for lesser black-backed gull are used for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA assessments, noting that 2022 counts were used for the RIAA (~~APP-027~~REP1-012).	B26 (Item 2 of the Rule 9 letter)	RR-061-88	2023 colony counts have been updated as the reference population for updated project alone and in-combination assessments for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA).	**Sections 2 (2.1.2) and 3**
NE requested that for 'gap filled' historic projects (Ormonde, Walney 1&2, Walney Extension, West of Duddon Sands) for lesser black-backed gull (Morecambe Bay and Duddon Estuary SPA) a proxy	B27 (Item 2 of the Rule 9 letter)	RR-061-89	The apportioning of mortality to the Ormonde, Walney 1&2, Walney Extension, West of Duddon Sands projects for the in-combination assessment for Morecambe Bay and Duddon Estuary SPA has been	**Sections ~~4.1.1.24.1.1.2~~34.1.1.2 and ~~4.1.2.14.1.2.1~~34.1.2.1**

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
apportioning value based on Walney 1&2 is used, rather than the rate for the Morecambe Project used in the RIAA (~~APP-027~~REP1-012).			updated, using a proxy value calculated by the Applicant for the Walney 1&2 project.	
NE requested that the lesser black-backed gull colonies used for the apportioning estimates for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA are re-appraised to exclude more distant colonies unlikely to have connectivity to the Project.	B29 (Item 2 of the Rule 9 letter)	RR-061-91	The Project apportioning estimates have been updated to exclude more distant colonies, as set out by Natural England in its response (PD1-017) to the ExA's Rule 9 letter (PD-006).	**Sections 2.1.1, 2.2.2 and 2.2.5**
NE requested that the Project consider additional increase in air gap (beyond 25m) to further increase mitigation for sensitive species.	B30	RR-061-92	The Applicant has presented a review of the effects of increasing air gap on the assessment conclusions. This has confirmed that increasing air gap from 25m to 28m or 30m above HAT would make no measurable difference to the in-combination effects on lesser black-backed gull from Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA, and therefore further increase in air gap would not be warranted. As noted in RR-061-92 in the Applicant's Response to Relevant Representations (PD1-010), there are also other constraints that limit the ability to increase air gap further.	**Section 5545**
NE requested that the assessment of effects on little gull from Liverpool Bay	B35	RR-061-97	The Applicant has presented an update to the assessment of project alone and in-	**Section 4.24.234.2**

Natural England Comment summary	Natural England Reference (RR-061)	Applicant Reference (PD1-011)	Applicant response	Document location
SPA are revisited to account for their advice regarding the cumulative effects on this species (B11/RR-061-74).			combination effects on little gulls from Liverpool Bay SPA. This confirms that there would be no changes to the assessment conclusions for this species, i.e. that there would be no adverse effect on integrity for this feature. The Applicant has also provided Natural England with the relevant input and output files for the collision risk model for this species.	
Additional comment from ExA in its Rule 8 Letter (PD-010) Annex B Item 4 The ExA has requested that collision risk modelling outputs are updated to reflect recent guidance issued by the Statutory Nature Conservation Bodies (August 2024).	n/a	n/a	Natural England provided the Applicant with an advanced draft of this guidance, which was used in the relevant assessment and submission documents. The Applicant can confirm that, as the draft guidance was used in the submitted assessment in the RIAA (~~APP-027~~REP1-012), there are no changes within the final SNCB guidance that would affect the assessment outcomes. No other changes to parameters used in the assessment have been identified. Note that for the in-combination assessment, collision risk values from other projects have been adjusted to the recommended avoidance rates, as set out in the SNCB guidance (August 2024), to ensure consistency across all projects that may contribute to in-combination mortality.	n/a

Table 1.2 Summary of Natural Resources Wales written representations addressed in this document

Natural Resources Wales Comment summary (REP1-099)	Applicant Reference (REP2-027)	Applicant response	Document location
The Applicant has applied inconsistent months to the estimation of seasonal mean peak abundances for gannet and Manx shearwater, and advised that these should be updated at the EIA scale and at the HRA scale for applicable Welsh SPAs.	WR-099-11 to WR-099-15	As noted by NRW, corrected values for gannet at the EIA scale were presented in the Applicant's response to the Rule 9 letter (PD1-010). Updates for Manx shearwater at the EIA scale are presented in Offshore Ornithology Technical Note 1 (EIA)_Rev 02 Clean (Document Reference 9.22~~the Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (REF~~). The Applicant has presented updated assessment for Manx shearwater at Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island Aberdaron Coast and Bardsey Island SPA and Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA, and gannet at Grassholm SPA within this document, to reflect NRW's comments. These updates have not affected the assessment conclusions, i.e. that there would be no adverse effect on integrity for any of these sites.	**Section 3**
The Applicant has not 'gap filled' historic projects for the in-combination assessment for projects where mortality data was not available.	WR-099-19 to WR-099-25	The in-combination assessments for Manx shearwater at Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island Aberdaron Coast and Bardsey Island SPA and Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA have been updated with 'gap-filled' data for historic projects. It is noted that no quantitative in-combination assessment for gannet from Grassholm SPA has been presented, as there would be no (zero) contribution to in-	**Section 3**

Natural Resources Wales Comment summary (REP1-099)	Applicant Reference (REP2-027)	Applicant response	Document location
		combination effects by the Project. Therefore, no gap-filling in respect of this site is required.	

2 Lesser black-backed gull assessment update (Project alone)

2.1 Approach

~~3.~~4. In accordance with Natural England's RRs (APP-061), the project alone HRA assessment for breeding lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA (as presented in Sections 8.5.2.2 and 8.6.3.2 of the RIAA (~~APP-027~~REP1-012)) has been updated to reflect the following changes requested by Natural England:

- Apportioning of potential lesser black-backed gull mortality to the two SPAs has been updated to remove more distant breeding colonies from the apportioning calculation.
- Updated 2023 colony counts for the two SPAs have been used as the reference population for the assessment of Project-alone effect.

~~4.~~5. Further information is provided below.

2.1.1 Apportioning update

~~5.~~6. The NatureScot apportioning tool (NatureScot, 2018) has been used to estimate the proportion of lesser black-backed gulls present at the windfarm site during the breeding season from each of the SPAs. For the RIAA submission (~~APP-027~~REP1-012), the Applicant included all lesser black-backed gull colonies within mean maximum foraging range plus one standard deviation (+1SD) (as defined by Woodward *et al*., 2019) in the apportioning calculation. In its RRs (RR-061), Natural England stated *'Natural England advise that in the absence of evidence, expert judgement is applied to critically appraise the likelihood of colonies contributing to the population observed within the project study area. Colonies considered unlikely to display connectivity, despite technically being within potential foraging range, should be disregarded during apportioning'*.

~~6.~~7. In its Rule 9 letter (PD-006), the ExA requested clarification from Natural England, to confirm which colonies should be excluded from the apportioning calculation. Natural England confirmed in its response (PD1-017) that inland (i.e. non-coastal) colonies and those beyond the mean maximum foraging range (127km; Woodward *et al.*, 2019 - as opposed to mean maximum +1SD) should be excluded. The Applicant presented apportioning estimates with inland colonies excluded in its original RIAA submission (~~APP-027~~REP1-012), and therefore the updated apportioning estimates have excluded any remaining coastal colonies that are beyond 127km from the Project site. The update has also taken into account the most recent colony counts for this species (refer to **Section 2.1.2** below).

~~7.~~8. Details of the sites included in the apportioning calculation are included in **Appendix 1**. It is noted that in the RIAA (~~APP-027~~REP1-012) the Applicant presented an assessment based on two apportioning scenarios, i.e. including and excluding inland breeding colonies. As Natural England has confirmed in its RRs (RR-061) that it considers that inland colonies should be excluded, only this scenario has been presented in the update. For the non-breeding periods the apportioning estimates are unchanged. The updated estimate has been used to recalculate the proportion of birds from the two SPAs potentially present at the Application Site, and hence the predicted collision mortality.

2.1.2 Updated colony counts

~~8.~~9. In its RRs (RR-061) Natural England advised that 2023 lesser black-backed colony counts for Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA should be used as the reference population for the assessment, as opposed to the 2021/22 counts used by the Applicant in the RIAA (~~APP-027~~REP1-012). The updated counts are as follows (values previously used in the RIAA in brackets):

- Morecambe Bay and Duddon Estuary SPA: 862 apparently occupied nests (AON), equivalent to 1,724 breeding adults (530 AON/1,060 adults)
- Ribble and Alt Estuaries SPA: 2,319 AON, equivalent to 4,638 breeding adults (4,489 AON/8,978 adults)

2.2 Project-alone assessment update

2.2.1 Morecambe Bay and Duddon Estuary SPA

2.2.2 Apportioning of effects

~~9.~~10. The updated apportioning (refer to **Appendix 1**) estimates that 19.21% of adult lesser black-backed gulls present at the windfarm site should be apportioned to the SPA. This compares to 9.50% in the RIAA (~~APP-027~~REP1-012). Of these, 71.2% are assumed to be adult birds (refer to paragraph 548 of the RIAA (~~APP-027~~REP1-012)). As set out in the RIAA, this is likely to be an overestimate (i.e. precautionary), as not all birds showing adult plumage characteristics are likely to be breeding (i.e. may be sub-adult or sabbatical birds). During the non-breeding periods, apportioning estimates are unchanged from the RIAA (~~APP-027~~REP1-012), comprising:

- 3.05% during the autumn migration period
- 4.85% during the winter period

- 3.05% during the spring migration period

~~10.~~11. Based on an adult breeding population of 1,724 breeding adults, and an adult baseline mortality rate of 0.115 (Horswill and Robinson, 2015), 198 breeding adults from the SPA population would be expected to die each year.

2.2.3 Operation and maintenance phase collision risk

~~11.~~12. The updated estimate of collision risk for breeding adult lesser black-backed gulls belonging to the Morecambe Bay and Duddon Estuary SPA population is presented in **Table 2.1~~Table 2.1~~~~Table 2.1~~**. Collision estimates, calculated using Option 2 of the sCRM (McGregor et al., 2018), are presented by biological season. A summary of the annual outputs and the corresponding increase in the annual baseline mortality rate is also presented.

~~12.~~13. The annual total of breeding adult lesser black backed gulls from the Morecambe Bay and Duddon Estuary SPA at risk of collision due to the Project is 0.33 birds. This would increase the existing background mortality of the SPA breeding population by 0.16%. This compares to a mortality of 0.19 birds and increase in background mortality of 0.15% previously presented in the RIAA (~~APP-027~~REP1-012).

~~13.~~14. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur in this population from the mean monthly collision estimates for the Project.

~~14.~~15. It is concluded that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Morecambe Bay and Duddon Estuary SPA and Ramsar. The assessment is therefore unchanged from that presented in the RIAA (~~APP-027~~REP1-012).

Table 2.1 Predicted seasonal and annual collision mortality (Stochastic model Option 2, avoidance rate 0.9940 (±0.0004)) for breeding adult lesser black-backed gulls at the windfarm site, apportioned to Morecambe Bay and Duddon Estuary SPA, with corresponding increases to baseline mortality of the population

	Breeding Season	Autumn Migration	Winter	Spring Migration	Annual
Period	Apr-Aug	Sep-Oct	Nov-Feb	Mar	Jan-Dec
Total collisions[1] (mean and 95% CIs)	1.44 (0.00-4.53)	1.25 (0.00-5.63)	0.15 (0.00-0.80)	0.15 (0.00-0.94)	**2.98 (0.00-11.90)**
% apportioned to the SPA	19.21%	3.05%	4.85%	3.05%	-
Total SPA collisions (mean and 95% CIs)	0.28 (0.00-0.87)	0.04 (0.00-0.17)	0.01 (0.00-0.04)	0.00 (0.00-0.03)	**0.33 (0.00-1.11)**
Mortality increase[2] (mean and 95% CIs)	0.14% (0.00-0.44%)	0.02% (0.00-0.09%)	0.00% (0.00-0.02%)	0.00% (0.00-0.01%)	**0.16% (0.00-0.56%)**

[1] Breeding season collision values reduced to 71.9% of modelled value to reflect proportion of adult birds recorded during site surveys.
[2] Assuming predicted annual SPA mortality of 198 birds (1,724 x 0.115)

2.2.4 Ribble and Alt Estuaries SPA

2.2.5 Apportioning of effects

~~15.~~16. The updated apportioning (refer to **Appendix 1**) estimates that 42.34% of adult lesser black-backed gulls present at the windfarm site should be apportioned to the SPA. This compares to 60.94% in the RIAA (~~APP-027~~REP1-012); the reduced proportion of birds reflects the smaller SPA breeding population used in the apportioning calculation. Of these, 71.2% are assumed to be adult birds (refer to paragraph 630 of the RIAA (~~APP-027)).~~REP1-012). As set out in the RIAA, this is likely to be an overestimate (i.e. precautionary), as not all birds showing adult plumage characteristics are likely to be breeding (i.e. may be sub-adult or sabbatical birds). During the non-breeding periods, apportioning estimates are unchanged from the RIAA (~~APP-027~~REP1-012), comprising:

- 5.06% during the autumn migration period
- 8.03% during the winter period
- 5.06% during the spring migration period

~~16.~~17. Based on an adult breeding population of 4,638 breeding adults, and an adult baseline mortality rate of 0.115 (Horswill and Robinson, 2015), 533 breeding adults from the SPA population would be expected to die each year.

2.2.6 Operation and maintenance phase collision risk

~~17.~~18. The updated estimate of collision risk for breeding adult lesser black-backed gulls belonging to the Ribble and Alt Estuaries SPA population is presented in **Table 2.2~~Table 2.2~~Table 2.2**. Collision estimates, calculated using Option 2 of the sCRM (McGregor *et al.*, 2018), are presented by biological season. A summary of the annual outputs and the corresponding increase in the annual baseline mortality rate is also presented.

~~18.~~19. The annual total of breeding adult lesser black backed gulls from the Ribble and Alt Estuaries SPA at risk of collision due to the Project is 0.69. This would increase the existing background mortality of the SPA breeding population ~~by 0~~by 0.13%. This compares to a mortality of 0.96 birds and increase in background mortality of 0.09% previously presented in the RIAA (~~APP-027~~REP1-012).

~~19.~~20. Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. This means that no detectable changes in mortality rates would occur in this population from the mean monthly collision estimates for the Project.

~~20.~~21. **It is concluded that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Ribble and Alt Estuaries SPA and Ramsar. The assessment is therefore unchanged from that presented in the RIAA (~~APP-027~~REP1-012).**

Table 2.2 Predicted seasonal and annual collision mortality (Stochastic model Option 2, avoidance rate 0.9940 (±0.0004)) for breeding adult lesser black-backed gulls at the windfarm site, apportioned to Ribble and Alt Estuaries SPA, with corresponding increases to baseline mortality of the population

	Breeding Season	Autumn Migration	Non-breeding/winter	Spring Migration	Annual
Period	Apr-Aug	Sep-Oct	Nov-Feb	Mar	Jan-Dec
Total collisions[1] (mean and 95% CIs)	1.44 (0.00-4.53)	1.25 (0.00-5.63)	0.15 (0.00-0.80)	0.15 (0.00-0.94)	**2.98 (0.00-11.90)**
% apportioned to the SPA	42.34%	5.06%	8.03%	5.06%	-
Total SPA collisions (mean and 95% CIs)	0.61 (0.00-1.92)	0.06 (0.00-0.28)	0.01 (0.00-0.06)	0.01 (0.00-0.05)	**0.69 (0.00-2.32)**
Mortality increase[2] (mean and 95% CIs)	0.11% (0.00-0.36%)	0.0% (0.00-0.05%)	0.00% (0.00-0.01%)	0.00% (0.00-0.01%)	**0.13% (0.00-0.43%)**

[1] Breeding season collision values reduced to 71.9% of modelled value to reflect proportion of adult birds recorded during site surveys.
[2] Assuming predicted annual SPA mortality of 533 birds (4,638 x 0.115)

3 Update of assessment for Welsh SPAs

3.1 Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA (Manx shearwater)

22. This section presents an update to the assessment of operation and maintenance phase effects on the Manx shearwater feature of the Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA. The updates reflect the adjusted seasonal periods advised by NRW (REP1-099), as set out in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA)_Rev 02 Clean (Document Reference 9.22).

23. Reference should be made to Section 8.21 of the RIAA (REP1-012) for relevant background information to support the updated assessment.

3.1.1 Reference population and background mortality

24. Based on the most recent SPA population of breeding adults (32,366), and an annual breeding adult baseline mortality rate of 0.1300 (Natural England, RR-061), 4,208 breeding adults from the SPA population would be expected to die each year; this is unchanged from the RIAA (REP1-012).

3.1.2 Updated apportioning

25. Manx shearwater that are present in the windfarm site during the breeding season are likely to originate from a number of different colonies within the Irish sea region, with the total count of Manx shearwater attributed to all the identified colonies (38 in total) being 1,299,546 adult birds, which is unchanged from the RIAA (REP1-012; see paragraphs 1000 – 1001). The breeding season period is defined fully as April – August (Furness, 2015).

26. The non-breeding population is 1,580,895 (UK Western Waters BDMPS; Furness, 2015), for the post-breeding (autumn) migration (September – October; changed from August – early October in the RIAA (REP1-012), paragraph 1003) and return (spring) migration (March; changed from late March – May in the RIAA (REP1-012) paragraph 1003). The estimates of the proportion of Manx shearwaters present at the windfarm site during the breeding season from each of the relevant SPAs is unchanged from the RIAA (REP1-012), see **Table 3.1~~Table 3.1~~Table 3.1** below, and paragraph 1002 in the RIAA (REP1-012) for further information.

Table 3.1 Manx shearwater breeding season apportioning

Site	Apportioning rate
Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA	**8.63%**
Copeland Islands SPA	2.22%
Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA	76.54%
Rum SPA	8.44%
St Kilda SPA	0.20%
Cruagh Island SPA (transboundary site)	0.10%
Blasket Islands SPA (transboundary site)	0.61%
Deenish Island and Scariff Island SPA (transboundary site)	0.08%
Puffin Island SPA (transboundary site)	0.22%
Skelligs SPA (transboundary site)	0.03%
Non-SPA colonies	2.91%

27. During the non-breeding periods, the estimates of the proportion of Manx shearwaters present at the windfarm site which originate from the Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA (and therefore the proportion of predicted mortalities from the SPA population) are based on the SPA population (as published in Furness (2015), i.e., 32,366 adults) as a proportion of the UK Western Waters BDMPS during the relevant season (1,580,895 birds during the post-breeding and return migration periods). Therefore, an apportioning rate of 2.05% of impacted birds is attributed to the Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA during the post-breeding and return migration periods. This is unchanged from the RIAA (REP1-012; paragraph 1004).

3.1.3 Operation and maintenance phase disturbance / displacement / barrier effects

28. The assessment has been updated in accordance with changes made to unapportioned mean peak populations, as highlighted by NRW in their written representations (REP1-099), and as presented in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA)_Rev 02 Clean (Document Reference 9.22). The previous unapportioned mean peak populations calculated for windfarm site and a 2 km buffer, on which this assessment was based ~~on~~ in the RIAA (REP1-012; paragraph 1011) for the breeding, autumn migration and spring migration periods were

4,705, 2,650 and 1,617, respectively (paragraph 1011 in the RIAA (REP1-012)). These values are now changed from the RIAA (REP1-012) to 5,161, 376 and zero, respectively.

29. During the breeding season, the number of birds at the site apportioned to Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA is 445 (i.e., 5,161 x 8.63%) (95% CI 248 – 679), this is changed from the RIAA (REP1-012) which estimated 406 birds (95% CI 68 – 864) apportioned to the SPA.

30. During the autumn migration period, the number of birds at the site apportioned to Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA is eight (i.e. 376 x 2.05%) (95% CI 1 – 20), this is changed from the RIAA (REP1-012) which estimated 54 birds (95% CI 27 – 91) apportioned to the SPA.

31. During the spring migration period, no birds from Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA are predicted to occur at the windfarm site +2km buffer; this is changed from 33 birds (95% CI 0 – 96) predicted within the RIAA (REP1-012).

32. Year-round, a total of 453 birds at the site are apportioned to Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA (95% CI 249 – 699), this is changed from the RIAA (REP1-012) which estimated 493 birds (95% CI 94 – 1,051) apportioned to the SPA.

33. The updated displacement matrices (mean values) for the assessed seasonal periods are shown below (**Table 3.2~~Table 3.2Table 3.2~~** – **Table 3.5~~Table 3.5Table 3.5~~**). A summary of the seasonal mean peak abundance estimates, the number of SPA breeding adults present in the Project area, by season, as well as predicted annual mortality and the relevant percentage increase to annual baseline mortality, is shown in **Table 3.6~~Table 3.6Table 3.6~~** below.

Table 3.2 Updated displacement matrix for Manx shearwater apportioned to Aberdaron Coast and Bardsey Island SPA during operation of the Project in the breeding season. Estimated mean population based on windfarm site ~~+~~plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	1	1	2	2	4	9	13	22	36	45
20%	1	2	3	4	4	9	18	27	45	71	89
30%	1	3	4	5	7	13	27	40	67	107	134
40%	2	4	5	7	9	18	36	53	89	143	178
50%	2	4	7	9	11	22	45	67	111	178	223
60%	3	5	8	11	13	27	53	80	134	214	267
70%	3	6	9	12	16	31	62	94	156	249	312
80%	4	7	11	14	18	36	71	107	178	285	356
90%	4	8	12	16	20	40	80	120	200	321	401
100%	4	9	13	18	22	45	89	134	223	356	445

Table 3.3 Updated displacement matrix for Manx shearwater apportioned to Aberdaron Coast and Bardsey Island SPA during operation of the Project in the autumn migration season. Estimated mean population based on windfarm site plus~~+~~ 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	1	1
20%	0	0	0	0	0	0	0	0	1	1	2
30%	0	0	0	0	0	0	0	1	1	2	2
40%	0	0	0	0	0	0	1	1	2	2	3
50%	0	0	0	0	0	0	1	1	2	3	4
60%	0	0	0	0	0	0	1	1	2	4	5
70%	0	0	0	0	0	1	1	2	3	4	5
80%	0	0	0	0	0	1	1	2	3	5	6
90%	0	0	0	0	0	1	1	2	3	6	7
100%	0	0	0	0	0	1	2	2	4	6	8

Table 3.4 Updated displacement matrix for Manx shearwater apportioned to Aberdaron Coast and Bardsey Island SPA during operation of the Project in the spring migration season. Estimated mean population based on windfarm site ~~+~~plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0
100%	0	0	0	0	0	0	0	0	0	0	0

Table 3.5 Updated displacement matrix for Manx shearwater apportioned to Aberdaron Coast and Bardsey Island SPA during operation of the Project year-round. Estimated mean population based on windfarm site ~~+~~plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	1	1	2	2	5	9	14	23	36	45
20%	1	2	3	4	5	9	18	27	45	72	91
30%	1	3	4	5	7	14	27	41	68	109	136
40%	2	4	5	7	9	18	36	54	91	145	181
50%	2	5	7	9	11	23	45	68	113	181	227
60%	3	5	8	11	14	27	54	82	136	217	272
70%	3	6	10	13	16	32	63	95	159	254	317
80%	4	7	11	14	18	36	72	109	181	290	362
90%	4	8	12	16	20	41	82	122	204	326	408
100%	5	9	14	18	23	45	91	136	227	362	453

Table 3.6 Updated Manx shearwater predicted operation and maintenance phase displacement and mortality from Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA

Mean peak abundance estimate type	Mean peak abundance estimate	Number of SPA breeding adults present by season[1]	Annual mortality range[2]	Annual baseline mortality increase range[3]
Upper 95% CI	7,873 (breeding) 963 (autumn) 0 (spring) 8,836 (year-round)	679 (breeding) 20 (autumn) 0 (spring) 699 (year-round)	2 – 49	0.05 – 1.16%
Mean	5,161 (breeding) 376 (autumn) 0 (spring) 5,537 (year-round)	445 (breeding) 8 (autumn) 0 (spring) 453 (year-round)	1 – 32	0.03 – 0.75%
Lower 95% CI	2,872 (breeding) 37 (autumn) 0 (spring) 2,909 (year-round)	248 (breeding) 1 (autumn) 0 (spring) 249 (year-round)	1 – 17	0.02 – 0.41%

[1] During the breeding season, assumes 8.6% of recorded birds are adults from the SPA population (32,366), and 2.05% during the autumn and spring migration periods

[2] Assumes displacement rates of 30 – 70% and mortality rates of 1 – 10%

[3] Background population is Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA breeding adults (32,366 individuals), adult age class annual mortality rate of 13.00% (Horswill and Robinson, 2015)

34. Using realistic values (i.e., mean density, 50% displacement and 1% mortality), there would be an annual mortality increase in 2.27 birds/0.05%. This is changed from 2.47 birds/0.06% in the RIAA (REP1-012). Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. **Therefore, no significant effects on Manx shearwater are predicted during the operation and maintenance phase, and it is concluded that there would be no adverse effect on the integrity of Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA.**

3.1.4 Potential effects in-combination with other projects

35. The in-combination assessment for Manx shearwaters from Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA during the operation and maintenance phase has been undertaken in accordance with the approach presented in Section 8.1 of the RIAA (REP1-012), with gap-filling work undertaken to cover additional historical OWFs (Burbo Bank, Gwynt y Môr, Rhyl Flats, Robin Rigg, and Walney 1&2) as advised by NRW (REP1-099). The total population apportioned to the SPA at risk of displacement is estimated to be 704 breeding adults, changed from 740 in the RIAA (REP1-012; see also Appendix 12.1 of the ES (APP-070)).

36. Updated EIA values for other projects have been applied in the in-combination assessment, where appropriate. These have been sourced from updated EIAs, errata notes and gap-filling exercises, as presented in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA) Rev 02 Clean (Document Reference 9.22).

37. The apportioning of the gap-filled projects (see above) was undertaken via proxy calculation, using the relative distance of these projects ($1/distance^2$) to Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA, when compared to the Project site. As with the RIAA (REP1-012), a weighted average annual apportioning rate was used, based on the total (annual) population estimate for each project, due to the lack of reliable seasonal data. **Table 3.7~~Table 3.7~~Table 3.7** presents the gap-filled projects with calculated apportioning rates and includes updated estimates for the Project as a result of the redefined seasonal periods. This updates Table 3.510 in Appendix 12.1 of the ES (APP-070).

38. The updated annual in-combination displacement and mortality rates for birds from Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA are presented in **Table 3.8~~Table 3.8~~Table 3.8** below. Assuming maximum displacement/mortality rates of 70%/10%, 49 breeding adults would be lost to displacement annually, which would increase the existing mortality within the SPA population (4,208 breeding adults per year) by 1.17%, this is

changed from 52 mortalities per annum with a mortality change of 1.23% in the RIAA (REP1-012).

39. Using realistic displacement/mortality rates of 50%/1%, the annual in-combination mortality would be four breeding adults, leading to a change in background mortality of 0.08%, this is changed from four mortalities and a change of 0.09% from the RIAA (REP1-012).

40. **The conclusion to the assessment is unchanged from that presented in the RIAA (REP1-012), i.e. that predicted Manx shearwater mortality due to ~~of~~ operational phase displacement impacts ~~of~~from the Project in-combination with other projects would not adversely affect the integrity of Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA**. This accords with the conclusions of the Round 4 offshore wind leasing HRA (NIRAS, 2021), which concluded no adverse effect on site integrity (for all SPAs) on the basis of the low vulnerability to OWFs and low density of this species within Round 4 areas.

*Table 3.7 Updated Manx shearwater in-combination annual population for displacement assessment apportioned to Aberdaron Coast & Bardsey Island SPA / Glannau Aberdaron ac Ynys Elli. Values changed from the RIAA (~~APP-076Rep~~EP1-012) and Appendix 12.1 (APP-070) are in **bold**.*

Project	EIA value	Apportioning proxy	Apportioning rate	Apportioned population from EIA	Population from HRA	Population for assessment
Burbo Bank	**3**	Morecambe derived	**5.46%**	**0**	N/A	**0**
Gwynt y Môr	**17**	Morecambe derived	**7.38%**	**1**	N/A	**1**
Rhyl Flats	**5**	Morecambe derived	**7.76%**	**0**	N/A	**0**
Robin Rigg	**4**	Morecambe derived	**3.16%**	**0**	N/A	**0**
Walney 1&2	**19**	Morecambe derived	**5.13%**	**1**	N/A	**1**
Burbo Bank Extension	**444**	Awel y Môr	4.21%	19	N/A	19
Ormonde	1,001	Morecambe	6.16%	62	N/A	62
Walney 3&4	**914**	Morecambe	6.16%	56	N/A	56
West of Duddon Sands	548	Morecambe	6.16%	34	N/A	34
Awel y Môr	417	N/A	N/A	N/A	9.43	9
Erebus	2,115	Erebus	0.96%	20	N/A	20
Twin Hub	1,274	White Cross	0.94%	12	N/A	12
White Cross	12,181	N/A	N/A	N/A	35.50	36
West of Orkney	**11**	N/A	N/A	N/A	0.00	0
Mona	**1,271**	Mona	0.77%	**10**	0	0
Morgan	**2,165**	Morgan	0.77%	**17**	0	0
Morecambe	**5,537**	N/A	N/A	N/A	**453**	**453**

Project	EIA value	Apportioning proxy	Apportioning rate	Apportioned population from EIA	Population from HRA	Population for assessment
Total	N/A	N/A	N/A	N/A	N/A	**704**

Table 3.8 Updated in-combination year-round displacement matrix for Manx shearwater from Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA. Values in red indicate a ≥1% increase in background mortality

Annual Mortality / Displacement	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	1	1	2	3	4	7	14	21	35	56	70
20%	1	3	4	6	7	14	28	42	70	113	141
30%	2	4	6	8	11	21	42	63	106	169	211
40%	3	6	8	11	14	28	56	84	141	225	281
50%	4	7	11	14	18	35	70	106	176	281	352
60%	4	8	13	17	21	42	84	127	211	338	422
70%	5	10	15	20	25	49	98	148	246	394	492
80%	6	11	17	23	28	56	113	169	281	450	563
90%	6	13	19	25	32	63	127	190	317	507	633
100%	7	14	21	28	35	70	141	211	352	563	704

Note: The cells show the number of birds predicted to die (rounded to the nearest integer) at a given rate of displacement and mortality. Highlighted cells are considered to be the most realistic scenario, in accordance with SNCB advice (SNCBs, 2022).

3.2 Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA (Manx shearwater)

41. This section presents an update to the assessment of operation and maintenance phase effects on the Manx shearwater feature of the Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA. The updates reflect the adjusted seasonal periods advised by NRW (REP1-099), as set out in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA)_Rev 02 Clean (Document Reference 9.22).

42. Reference should be made to Section 8.32 of the RIAA (REP1-012) for relevant background information to support the updated assessment.

3.2.1 Reference population and background mortality

43. Based on the most recent SPA population of breeding adults (455,156), and an annual breeding adult baseline mortality rate of 0.1300 (Natural England, RR-061), 118,341 breeding adults from the SPA population would be expected to die each year; this is unchanged from the RIAA (REP1-012).

3.2.2 Updated apportioning

44. Manx shearwater that are present in the windfarm site during the breeding season are likely to originate from a number of different colonies within the Irish sea region, with the total count of Manx shearwater attributed to all the identified colonies (38 in total) remainings as 1,299,546 adult birds, which is unchanged from the RIAA (REP1-012; see paragraphs 1000 – 1001). The breeding season period is defined fully as April – August (Furness, 2015).

45. The non-breeding population is 1,580,895 (UK Western Waters BDMPS; Furness, 2015), for the post-breeding (autumn) migration (September – October; changed from August – early October in the RIAA (REP1-012), paragraph 1383) and return (spring) migration (March; changed from late March – May in the RIAA (REP1-012) paragraph 1384). The estimates of the proportion of Manx shearwaters present at the windfarm site during the breeding season from each of the relevant SPAs is unchanged from the RIAA (REP1-012), see **Table 3.9~~Table 3.9Table 3.9~~** below, and paragraph 1383 in the RIAA (REP1-012) for further information.

Table 3.9 Manx shearwater breeding season apportioning

Site	Apportioning rate
Glannau Aberdaron ac Ynys Enlli/Aberdaron Coast and Bardsey Island SPA	8.63%
Copeland Islands SPA	2.22%
Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA	**76.54%**
Rum SPA	8.44%
St Kilda SPA	0.20%
Cruagh Island SPA (transboundary site)	0.10%
Blasket Islands SPA (transboundary site)	0.61%
Deenish Island and Scariff Island SPA (transboundary site)	0.08%
Puffin Island SPA (transboundary site)	0.22%
Skelligs SPA (transboundary site)	0.03%
Non-SPA colonies	2.91%

46. During the non-breeding periods, the estimates of the proportion of Manx shearwaters present at the windfarm site which originate from the Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA during the post-breeding and return migration periods (and therefore the proportion of predicted mortalities from the SPA population) are based on the SPA population (as published in Furness (2015); i.e. 700,000 adults) as a proportion of the UK Western Waters BDMPS during the relevant season (1,580,895 birds during the post-breeding and return migration periods). Therefore, 44.28% of impacted birds are attributed to the Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA during the post-breeding and return migration periods. This is unchanged from the RIAA (REP1-012; paragraph 1385).

3.2.3 Operation and maintenance phase disturbance / displacement / barrier effects

47. The assessment has been updated in accordance with changes made to unapportioned mean peak populations, as highlighted by NRW in their written representations (REP1-099), and as presented in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA)_Rev 02 Clean (Document Reference 9.22). The previous unapportioned mean peak populations calculated for windfarm site and a 2 km buffer, on which this assessment was based on in the RIAA (REP1-012; paragraph

1391) for the breeding, autumn migration and spring migration periods were 4,705, 2,650 and 1,617 respectively (paragraph 1391 in the RIAA (REP1-012)). These values are now changed from the RIAA (REP1-012) to 5,161, 376 and zero, respectively.

48. During the breeding season, the number of birds at the site apportioned to Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA is 3,950 (i.e., 5,161 x 76.54%) (95% CI 2,198 – 6,026), this is changed from the RIAA (REP1-012) which estimated 3,601 birds (95% CI 600 – 7,662) apportioned to the SPA.

49. During the autumn migration period, the number of birds at the site apportioned to Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA is 166 (i.e. 376 x 44.28%) (95% CI 0 – 6), this is changed from the RIAA (REP1-012) which estimated 1,174 birds (95% CI 579 – 1,969) apportioned to the SPA.

50. During the spring migration period, no birds from Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA are predicted to occur at the windfarm site +2km buffer; this is changed from 716 birds (95% CI 0 – 2,086) predicted within the RIAA (REP1-012).

51. Year-round, a total of 4,117 birds at the site are apportioned to Skomer, Skokholm and the Seas off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA (95% CI 2,215 – 6,452), this is changed from the RIAA (REP1-012) which estimated 5,491 birds (95% CI (1,179 – 11,717) apportioned to the SPA.

52. The updated displacement matrices (mean values) for the assessed seasonal periods are shown below (**Table 3.10~~Table 3.10Table 3.10~~** – **Table 3.13~~Table 3.13Table 3.13~~**). A summary of the seasonal mean peak abundance estimates, the number of SPA breeding adults present in the Project area, by season, as well as predicted annual mortality and the relevant percentage increase to annual baseline mortality, is shown in **Table 3.14~~Table 3.14Table 3.14~~** below.

Table 3.10 Updated displacement matrix for Manx shearwater apportioned to Skomer, Skokholm and the Sea off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA during operation of the Project in the breeding season. Estimated mean population based on windfarm site plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	4	8	12	16	20	40	79	119	198	316	395
20%	8	16	24	32	40	79	158	237	395	632	790
30%	12	24	36	47	59	119	237	356	593	948	1185
40%	16	32	47	63	79	158	316	474	790	1264	1580
50%	20	40	59	79	99	198	395	593	988	1580	1975
60%	24	47	71	95	119	237	474	711	1185	1896	2370
70%	28	55	83	111	138	277	553	830	1383	2212	2765
80%	32	63	95	126	158	316	632	948	1580	2528	3160
90%	36	71	107	142	178	356	711	1067	1778	2844	3555
100%	40	79	119	158	198	395	790	1185	1975	3160	3950

Table 3.11 Updated displacement matrix for Manx shearwater apportioned to Skomer, Skokholm and the Sea off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA during operation of the Project in the autumn migration season. Estimated mean population based on windfarm site ~~+~~ plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	1	1	2	3	5	8	13	17
20%	0	1	1	1	2	3	7	10	17	27	33
30%	0	1	1	2	2	5	10	15	25	40	50
40%	1	1	2	3	3	7	13	20	33	53	67
50%	1	2	2	3	4	8	17	25	42	67	83
60%	1	2	3	4	5	10	20	30	50	80	100
70%	1	2	3	5	6	12	23	35	58	93	117
80%	1	3	4	5	7	13	27	40	67	107	133
90%	1	3	4	6	7	15	30	45	75	120	150
100%	2	3	5	7	8	17	33	50	83	133	166

Table 3.12 Updated displacement matrix for Manx shearwater apportioned to Skomer, Skokholm and the Sea off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA during operation of the Project in the spring migration season. Estimated mean population based on windfarm site plus~~+~~ 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean	Mortality										
Displacement	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0
100%	0	0	0	0	0	0	0	0	0	0	0

Table 3.13 Updated displacement matrix for Manx shearwater apportioned to Skomer, Skokholm and the Sea off Pembrokeshire/ Sgomer, Sgogwm a Moroedd Penfro SPA during operation of the Project year-round. Estimated mean population based on windfarm site plus~~+~~ 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	4	8	12	16	21	41	82	124	206	329	412
20%	8	16	25	33	41	82	165	247	412	659	823
30%	12	25	37	49	62	124	247	371	618	988	1235
40%	16	33	49	66	82	165	329	494	823	1317	1647
50%	21	41	62	82	103	206	412	618	1029	1647	2058
60%	25	49	74	99	124	247	494	741	1235	1976	2470
70%	29	58	86	115	144	288	576	865	1441	2305	2882
80%	33	66	99	132	165	329	659	988	1647	2635	3293
90%	37	74	111	148	185	371	741	1112	1853	2964	3705
100%	41	82	124	165	206	412	823	1235	2058	3293	4117

Table 3.14 Updated Manx shearwater predicted operation and maintenance phase displacement and mortality Skomer, Skokholm and the Seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA

Mean peak abundance estimate type	Mean peak abundance estimate	Number of SPA breeding adults present by season[1]	Annual mortality range[2]	Annual baseline mortality increase range[3]
Upper 95% CI	7,873 (breeding) 963 (autumn) 0 (spring) 8,836 (year-round)	6,026 (breeding) 426 (autumn) 0 (spring) 6,452 (year-round)	19 – 452	0.02 – 0.38%
Mean	5,161 (breeding) 376 (autumn) 0 (spring) 5,537 (year-round)	3,950 (breeding) 166 (autumn) 0 (spring) 4,117 (year-round)	12 – 288	0.01 – 0.24%
Lower 95% CI	2,872 (breeding) 37 (autumn) 0 (spring) 2,909 (year-round)	2,198 (breeding) 16 (autumn) 0 (spring) 2,215 (year-round)	7 – 155	0.01 – 0.13%

[1] During the breeding season, assumes 76.5% of recorded birds are adults from the SPA population (910,312), and 44.3% during the autumn and spring migration periods

[2] Assumes displacement rates of 30 – 70% and mortality rates of 1 – 10%

[3] Background population is ~~Background population is~~ Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA breeding adults (910,312 individuals), adult age class annual mortality rate of 13.00% (Horswill and Robinson, 2015)

56. Using realistic values (i.e., mean density, 50% displacement and 1% mortality), there would be an annual mortality increase ~~in~~of 20.58 birds/0.02%, which is changed from 27.45 birds in the RIAA (REP1-012). Increases in the existing mortality rate of less than 1% are likely to be undetectable against natural variation. Therefore, no significant effects on Manx shearwater are predicted during the operation and maintenance phase, and it is concluded that there would be no adverse effect on the integrity of Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA.

3.2.4 Potential effects in-combination with other projects

57. During the operation and maintenance phase, the in-combination assessment for Manx shearwaters from Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA has been undertaken in accordance with the approach presented in Section 8.1 of the RIAA (REP1-012), with gap-filling work undertaken to cover additional historical OWFs (Burbo Bank, Gwynt y Môr, Rhyl Flats, Robin Rigg, and Walney 1&2) as advised by NRW (REP1-099). The total population apportioned to the SPA at risk of displacement is estimated to be 15,814 breeding adults, changed from 17,152 in the RIAA (REP1-012; see also Appendix 12.1 of the ES (APP-070)).

58. Updated EIA values for other projects have been applied in the in-combination assessment, where appropriate. These have been sourced from updated EIAs, errata notes and gap-filling exercises, as presented in Rev 02 of the Offshore Ornithology Technical Note 1 (EIA) (Offshore Ornithology Technical Note 1 (EIA) Rev 02 Clean (Document Reference 9.22).

59. The apportioning of the added projects (see above) was undertaken via proxy calculation, using the relative distance of these projects (1/distance^2) to Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA, when compared to the Project site. As with the RIAA (REP1-012), a weighted average annual apportioning rate was used, based on the total (annual) population estimate for each project, due to the lack of reliable seasonal data. **Table 3.15~~Table 3.15~~Table 3.15** presents the gap-filled projects with calculated apportioning rates and includes updated estimates for the Project as a result of the re-defined seasonal periods. This updates Table 3.512 in Appendix 12.1 of the ES (APP-070).

60. The updated in-combination displacement and mortality rates for birds from Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA are presented in **Table 3.16~~Table 3.16~~Table 3.16** below. Assuming maximum displacement/mortality rates of 70%/10%, 1,107 breeding adults would be lost to displacement annually, which would increase the existing mortality within the SPA population (118,341 breeding adults per

year) by 0.94%, this is changed from 1,201 mortalities per annum with a mortality change of 1.01% in the RIAA (REP1-012).

61. Using realistic displacement/mortality rates of 50%/1%, the annual in-combination mortality would be 79 breeding adults, leading to a change in background mortality of 0.07%, this is changed from 86 birds and ~~a change of~~amounts to the same background mortality of 0.07% in the RIAA (REP1-012).

62. **The conclusion to the assessment is unchanged from that presented in the RIAA (REP1-012), i.e. that predicted Manx shearwater mortality due to ~~of~~ operational phase displacement impacts ~~of~~from the Project in-combination with other projects, would not adversely affect the integrity of Skomer, Skokholm and the Seas off Pembrokeshire/Sgomer, Sgogwm a Moroedd Penfro SPA.** This accords with the conclusions of the Round 4 offshore wind leasing HRA (NIRAS, 2021), which concluded no adverse effect on site integrity (for all SPAs) on the basis of the low vulnerability to OWFs and low density of this species within Round 4 areas.

*Table 3.15 Updated Manx shearwater in-combination annual population for displacement assessment apportioned to Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA. Values changed from the RIAA (APP-076) and Appendix 12.1 (APP-070) are in **bold**.*

Project	EIA value	Apportioning proxy	Apportioning rate	Apportioned population from EIA	Population from HRA	Population for assessment
Burbo Bank	**3**	Morecambe derived	**61.03%**	**2**	N/A	**2**
Gwynt y Môr	**17**	Morecambe derived	**70.50%**	**12**	N/A	**12**
Rhyl Flats	**5**	Morecambe derived	**72.13%**	**4**	N/A	**4**
Robin Rigg	**4**	Morecambe derived	**45.80%**	**2**	N/A	**2**
Walney 1&2	**19**	Morecambe derived	**59.17%**	**11**	N/A	**11**
Burbo Bank Extension	**444**	Awel y Mor	44.36%	**197**	N/A	**197**
Ormonde	1,001	Morecambe	64.44%	645	N/A	645
Walney 3&4	**914**	Morecambe	64.44%	**589**	N/A	**589**
West of Duddon Sands	548	Morecambe	64.44%	**353**	N/A	**353**
Awel y Môr	417	N/A	N/A	N/A	184.68	185
Erebus	2,115	Erebus	78.79%	1,666	N/A	1,666
Twin Hub	1,274	White Cross	54.31%	692		692
White Cross	12,181	N/A	N/A	N/A	7,338	7,338
West of Orkney	**11**	N/A	N/A	N/A	0	0
Mona	**1,271**	N/A	N/A	N/A	0	0
Morgan	**2,165**	N/A	N/A	N/A	0	0
Morecambe	**5,537**	N/A	N/A	N/A	**4,117**	**4,117**
Total	N/A	N/A	N/A	N/A	N/A	**15,813**

Table 3.16 Updated in-combination year-round displacement matrix for Manx shearwater from Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA. Values in red indicate a ≥1% increase in background mortality

Annual Displacement	Mortality 1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	16	32	47	63	79	158	316	474	791	1265	1581
20%	32	63	95	127	158	316	633	949	1581	2530	3163
30%	47	95	142	190	237	474	949	1423	2372	3795	4744
40%	63	127	190	253	316	633	1265	1898	3163	5060	6325
50%	79	158	237	316	395	791	1581	2372	3953	6325	7907
60%	95	190	285	380	474	949	1898	2846	4744	7590	9488
70%	111	221	332	443	553	1107	2214	3321	5535	8855	11069
80%	127	253	380	506	633	1265	2530	3795	6325	10120	12650
90%	142	285	427	569	712	1423	2846	4270	7116	11385	14232
100%	158	316	474	633	791	1581	3163	4744	7907	12650	15813

Note: The cells show the number of birds predicted to die (rounded to the nearest integer) at a given rate of displacement and mortality. Highlighted cells are considered to be the most realistic scenario, in accordance with SNCB advice (SNCBs, 2022).

3.3 Grassholm SPA (Gannet)

63. This section presents an update to the assessment of operation and maintenance phase effects on the gannet feature of the Grassholm SPA. The updates reflect the adjusted seasonal periods advised by Natural England (RR-061) and NRW (REP1-099) as set out in the Applicant's response to the Rule 9 letter (PD1-010).

64. Reference should be made to Section 8.33 of the RIAA (REP1-012) for relevant background information to support the updated assessment.

65. The updated abundance of gannets used for the displacement assessment (windfarm site plus 2km buffer) in the breeding season, autumn and spring migrations has been detailed in the Applicant's response to the Rule 9 letter (PD1-010). These changes led to updated mean peak EIA scale values for the autumn and spring migration periods of 14 and zero~~,~~ respectively, with no change to the breeding season mean peak of 541; a year-round total of 555 individuals.

3.3.1 Apportioning

66. Apportioning of gannets from Grassholm SPA is unchanged from the RIAA (REP1-012). No birds are apportioned to Grassholm SPA during the breeding season, as detailed in paragraph 1492 in the RIAA (REP1-012; paragraphs 1492 – 1494), based on the evidence presented in Wakefield *et al.,* 2013.

67. Estimates of the proportion of gannets present at the windfarm site which originate from the Grassholm SPA during the non-breeding season (and therefore the proportion of predicted mortalities from the SPA population) are based on the SPA population (i.e. 78,584 breeding adults) as a proportion of the UK Western Waters BDMPS during the relevant season. During autumn migration and spring migration, 14.4%, and 11.9% of impacts are considered to affect birds from the SPA respectively (Furness, 2015).

3.3.2 Operation and maintenance phase disturbance / displacement / barrier effects

68. Displacement effects for gannet for the Project were assessed during the autumn and spring migration periods, based on the updated unapportioned peak mean populations of 14 and zero birds respectively, which is changed from 124 and eight birds in the RIAA (REP1-012). These numbers are calculated for the windfarm site and a 2 km buffer, and the effects are assessed based on displacement rates of 60 – 80% and a mortality rate of 1% (see paragraph 1497 in the RIAA (REP1-012) for further information).

69. As set out above, no birds are apportioned to Grassholm SPA during the breeding season.

70. During the autumn migration period, the number of birds at the site apportioned to Grassholm SPA is two (i.e. 14 x 14.4%) (95% CI 0 – 6), this is changed from the RIAA (REP1-012) which estimated 18 birds (95% CI 0 – 27) apportioned to the SPA.

71. During the spring migration period, no birds from the SPA are predicted to occur at the windfarm site plus a ~~+~~2 km buffer; this is changed from one bird (95% CI 0 – 2) predicted within the RIAA (REP1-012).

72. Year-round, a total of two birds at the site are apportioned to Grassholm SPA (95% CI 0 – 6), this is changed from the RIAA (REP1-012) which estimated 19 birds (95% CI (0 – 29) apportioned to the SPA.

73. The updated displacement matrices (mean values) for the assessed seasonal periods are shown below (**Table 3.17**~~**Table 3.17Table 3.17**~~ – **Table 3.19**~~**Table 3.19Table 3.19**~~). A summary of the changes made to the seasonal mean peak abundance estimates, the number of SPA breeding adults present in the Project area, by season, as well as predicted annual mortality and the relevant percentage increase to annual baseline mortality, is shown in **Table 3.20**~~**Table 3.20Table 3.20**~~ below.

Table 3.17 Updated displacement matrix for gannet apportioned to Grassholm SPA during operation of the Project in the autumn migration season. Estimated mean population based on windfarm site plus~~+~~ 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	1
40%	0	0	0	0	0	0	0	0	0	1	1
50%	0	0	0	0	0	0	0	0	0	1	1
60%	0	0	0	0	0	0	0	0	1	1	1
70%	0	0	0	0	0	0	0	0	1	1	1
80%	0	0	0	0	0	0	0	0	1	1	2
90%	0	0	0	0	0	0	0	1	1	1	2
100%	0	0	0	0	0	0	0	1	1	2	2

Table 3.18 Updated displacement matrix for gannet apportioned to Grassholm SPA during operation of the Project in the spring migration season. Estimated mean population based on windfarm site plus +2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean	Mortality										
Displacement	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0
40%	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0
60%	0	0	0	0	0	0	0	0	0	0	0
70%	0	0	0	0	0	0	0	0	0	0	0
80%	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0
100%	0	0	0	0	0	0	0	0	0	0	0

Table 3.19 Updated displacement matrix for gannet apportioned to Grassholm SPA during operation of the Project year-round. Estimated mean population based on windfarm site plus 2 km buffer area. Ranges of displacement and mortality considered by the assessment are shown in grey cells. Values in red indicate a ≥1% increase in background mortality

Mean Displacement	Mortality										
	1%	2%	3%	4%	5%	10%	20%	30%	50%	80%	100%
10%	0	0	0	0	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	1
40%	0	0	0	0	0	0	0	0	0	1	1
50%	0	0	0	0	0	0	0	0	0	1	1
60%	0	0	0	0	0	0	0	0	1	1	1
70%	0	0	0	0	0	0	0	0	1	1	1
80%	0	0	0	0	0	0	0	0	1	1	2
90%	0	0	0	0	0	0	0	1	1	1	2
100%	0	0	0	0	0	0	0	1	1	2	2

*Table 3.20 Updated predicted operation and maintenance phase displacement and mortality of Gannet from Grassholm SPA. Changes from the RIAA (REP1-012) in **bold**.*

Mean peak abundance estimate type	Mean peak abundance estimate	Number of SPA breeding adults present by season[1]	Annual mortality range[2]	Annual baseline mortality increase range[3]
Upper 95% CI	809 (breeding) **40** (autumn) **0** (spring) **849** (year-round)	0 (breeding) **6** (autumn) **0** (spring) **6** (year-round)	0 – 0	0.00 – 0.00%
Mean	541 (breeding) **14** (autumn) **0** (spring) **555** (year-round)	0 (breeding) **2** (autumn) **0** (spring) **2** (year-round)	0 – 0	0.00 – 0.00%
Lower 95% CI	160 (breeding) 0 (autumn) 0 (spring) 160 (year-round)	0 (breeding) 0 (autumn) 0 (spring) 0 (year-round)	0 – 0	0.00 – 0.00%

[1] 14.4% and 11.9% of birds are assumed to be breeding adults from the SPA population during the autumn and spring migration periods respectively.

[2] Assumes displacement rates of 60-80% and mortality rate of 1%.

[3] Background population is Grassholm SPA breeding adults (72,022 individuals), adult age class annual mortality rate of 8.1% (Horswill and Robinson, 2015).

75. Using the maximum potential mortality value, there would be no measurable increase in gannet mortality. No significant effects on gannet are predicted from disturbance/displacement during the operation and maintenance phase, and the conclusions presented in the RIAA (REP1-012) remain unchanged, i.e., that **there would be no potential for the Project to have an adverse effect on the integrity of Grassholm SPA**.

3.3.3 Operation and maintenance phase collision risk

76. **Table 3.21~~Table 3.21~~~~Table 3.21~~** below summarises the collision risk on breeding adult gannets belonging to ~~the~~ Grassholm SPA, updated from the values and definition of seasonal periods presented in the RIAA (REP1-012).

77. Based on the updated mean collision rates, it remains that no breeding adult gannets from Grassholm SPA are considered at risk of collision as a result of the Project. Therefore, there would be no measurable increase in the existing mortality of the SPA breeding population.

*Table 3.21 Updated predicted seasonal and annual collision mortality (Stochastic model Option 2, avoidance rate 0.993 (±0.0003), plus 70% macro-avoidance) for breeding adult gannets at the windfarm site, apportioned to Grassholm SPA, with corresponding increases to baseline mortality of the population. Result changes from the RIAA (REP1-012) in **bold***

Period	Breeding Season Mar-Sep	Autumn Migration Oct-Nov	Non-breeding/winter -	Spring Migration Dec-Feb	Annual Jan-Dec
Total collisions[1] (mean and 95% CIs)	**0.92** (0.00 – **3.81**)	**0.02** (0.00 – **0.13**)	-	0.00 (0.00 – 0.00)	**0.94** (0.00 – **3.93**)
% apportioned to the SPA	0.00%	14.4%	-	11.9%	-
Total SPA collisions (mean and 95% CIs)	-	**0.00** (0.00 – **0.02**)	-	-	**0.00** (0.00 – **0.02**)
Mortality increase[2] (mean and 95% CIs)	-	0.00% (0.00 – 0.00%)	-	-	0.00% (0.00 – 0.00%)

[1] Collision values reduced to 73.8% of modelled value to reflect proportion of adult birds recorded during the breeding season.

[2] Assuming predicted annual SPA mortality of 5,834 birds (72,022 x 0.081).

78. **Accordingly, no significant effects on gannet are predicted during the operation and maintenance phase, and it is concluded that there would be no potential for the Project to have an adverse effect on the integrity of Grassholm SPA.** Comments received from RSPB during the ETG process, indicating that they do not accept the 70% macro-avoidance rate for collision risk recommended by Natural England, are noted. However, even in the absence of this correction factor, the net increase in mortality would be unchanged (i.e. zero).

3.3.4 Combined displacement/barrier effects and collision risk

79. The combined assessment conclusion is unchanged from the RIAA (REP1-012).

80. As no measurable increase in mortality is predicted for both displacement and collision risk, the mean combined displacement and collision rates for breeding adult gannet from the Grassholm SPA would be zero. Therefore, there would be no net increase in existing mortality rates.

81. It is concluded that based on predicted gannet mortality due to the combined effects of operational phase displacement and collision there is no potential for the Project -alone to have an adverse effect on the integrity of the Grassholm SPA.

3.3.5 Potential effects in-combination with other projects

82. As no measurable effects of displacement/barrier and collision on gannet are predicted as a result of the Project -alone, there would be no contribution to other plans or projects in-combination. **It is therefore concluded that there would be no potential for the Project -alone or in-combination with other plans or projects to have an adverse effect on the integrity of Grassholm SPA**. This is unchanged from the conclusion presented in the RIAA (REP1-012).

~~3~~4 In-combination assessment update

~~3.1~~4.1 Lesser black-backed gull

~~3.1.1~~4.1.1 Approach

~~21.~~83. As requested by Natural England in its RRs (APP-061), the in-combination assessment for lesser black backed gull (Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries) has been updated as follows:

- Data for in-combination mortality has been updated to ‘gap-fill’ one historic project for which no data had previously been identified (Robin

Rigg offshore windfarm), and values for other projects have been updated to reflect the 'gap fill' assessment updates for the Morgan Generation and Mona offshore windfarm projects (RPS, 2024a and 2024b, NIRAS, 2024)

- The 'proxy' apportioning rate for some historic windfarms used in the in-combination assessment for Morecambe Bay and Duddon Estuary SPA (Ormonde, Walney 1&2, Walney 3&4 (Walney Extension) and West of Duddon Sands) has been reviewed and updated.
- The in-combination totals have been updated to reflect the updated Project-alone contributions (as presented in **Section 2.2**).
- Increase in background mortality and Population Viability Analysis (PVA) outputs have been updated to reflect the updated in-combination mortality estimates (as above) and updated colony counts for the two SPAs (refer to **Section 2.1.2**).

~~22.~~84. The Applicant reiterates its position, as set out in the RIAA (~~APP-027~~REP1-012) that due to the very low predicted lesser black-backed gull collision mortality for the Project alone (equating to a small fraction of a bird for both SPAs), and for the reasons set in the RIAA (~~APP-027~~REP1-012) (paragraphs 599 and 643), there would be no measurable contribution of the Project to in-combination effects. **Accordingly, no in-combination assessment is required for this feature. The conclusion of the Project-alone assessment is therefore unchanged, i.e. that predicted lesser black-backed gull mortality due to collision at the Project windfarm site would not adversely affect the integrity of the Morecambe Bay and Duddon Estuary SPA and Ramsar or the Ribble and Alt Estuaries SPA and Ramsar.** The in-combination updates are therefore presented without prejudice to this position, to provide context to the Project-alone assessment.

~~23.~~85. Further information on the approach is provided in the following sections.

~~3.1.1.1~~4.1.1.1 Gap-filling approach

~~24.~~86. Unapportioned estimates of lesser black-backed gull mortality have been obtained from the cumulative effect assessment update for this species presented in the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26) that has been issued alongside this note. Reference should be made to this document for the approach that was used to obtain this data. For each project, mortality was apportioned to the SPA using the same approach as for the RIAA (~~APP-027~~REP1-012), noting that this approach has been updated for some projects (see **Section ~~4.1.1.2~~4.1.1.~~23~~4.1.1.2** below).

~~25.~~87. As set out in Paragraph 413 of the RIAA (~~APP-027~~REP1-012), where published apportioned values were available from project assessment reports, these have been used in the in-combination assessment. For the majority of

projects where no apportioning information was available, EIA values were apportioned using available rates from nearby projects (see also **Section ~~4.1.1.24.1.1.234~~4.1.1.2** below). There is significant inconsistency between projects on the availability and presentation of seasonal values used for species in the assessment, and for that reason only annual values have been considered within the assessment conclusions. Where seasonal data were unavailable (or unclear), a weighted average apportioning rate was applied, using a suitable nearby proxy project. Weighting for each season was undertaken based on the proportion of months within the year for each season (as defined by Furness, 2015), and assuming that estimated total annual population estimates were evenly distributed across the year.

~~3.1.1.2~~4.1.1.2 Proxy apportioning update

~~26.~~88. Natural England advised in its RRs (RR-061) that it did not consider it appropriate to use the Project apportioning values as a proxy for the Ormonde, Walney 1&2, Walney 3&4 and West of Duddon Sands projects. It advised that '*an appropriate value for apportioning birds from Walney 1 & 2 (as the central OWF in the cluster) to Morecambe Bay and Duddon Estuary SPA is calculated, and that this value is used as the proxy value for other wind farms in the cluster*'. The Applicant discussed this comment with Natural England during post-submission consultation meetings (12 September and 30 October 2024). The Applicant confirmed to Natural England that it would be disproportionate to provide bespoke breeding season apportioning for the Walney 1&2 project using the NatureScot tool, but that the Project apportioning rate for the breeding season would be adjusted proportionately to reflect the relative distance of the Walney 1&2 project from the SPA, when compared to the Project. It is noted that this update does not affect non-breeding seasons, as these are calculated separately based on data in Furness (2015).

~~3.1.1.3~~4.1.1.3 Update to in-combination totals, background mortality and PVA

~~27.~~89. The total (annual) in-combination lesser black-backed gull mortality was calculated based on the parameters set out above. This total was used to estimate the increase in background mortality for each SPA population, based on 2023 colony counts (refer to **Section 2.1.2**), and an adult mortality rate of 0.115 (Horswill and Robinson, 2015). Finally, PVA was undertaken for the 35-year operational period of the Project using the Seabird PVA Tool developed by Natural England (Searle et al. 2019) via the 'Shiny App' interface. Refer to the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26) for further information on the application of the PVA tool, and **Appendix 2** for the input parameters used in the PVA.

~~3.1.2~~4.1.2 In-combination assessment update: Morecambe Bay and Duddon Estuary SPA

~~3.1.2.1~~4.1.2.1 Proxy apportioning update

~~28.~~90. The proxy apportioning rate for lesser black-backed gull used for the Ormonde, Walney 1&2, Walney 3&4 and West of Duddon Sands projects has been updated, based on the Project apportioning rate but adjusted for the relative distance between the central point of the Project and the SPA breeding colony, and the same measurement between the central point of Walney 1&2 and the SPA breeding colony. Following the approach used in the NatureScot apportioning tool, this distance has been weighted to account for the reduced density of birds as they radiate from the colony; calculated as 1/distance^2. These distances were estimated using QGIS; and the relative proportions of the weighted distance used to adjust the Project breeding season apportioning. The results of this calculation, also including the contributions of the non-breeding seasons to generate a weighted average annual apportioning value, are presented in **Table 4.1~~Table 4.1~~Table ~~3~~4.1~~**. It is noted that the distance weighting is not applied to the non-breeding seasons, as these values assume that the SPA population is distributed throughout the BDMPS region at this time, and are therefore the same for all projects within the BDMPS, irrespective of distance from the SPA.

Table 4.1 Apportioning calculation for Walney 1&2 project for lesser black-backed gull from Morecambe Bay and Duddon Estuary SPA

	The Project	Walney 1&2
Distance to colony (South Walney) (km)	38.1	32.1
Weighted distance (1/distance^2)	0.00068889	0.000970487
Relative weighted distance	n/a	1.41[1]
Breeding season apportioning rate	19.21%	27.06%[2]
% adult birds[3]	71.20%	71.20%
Final breeding season apportioning rate[4]	**13.68%**	**19.27%**
Autumn apportioning rate	3.05%	3.05%
Winter apportioning rate	4.85%	4.85%
Spring apportioning rate	3.05%	3.05%
Weighted average apportioning rate[5]	**8.08%**	**10.41%**

[1] Calculated as the weighted distance for Walney 1&2 divided by the weighted distance for the Project.

[2] The Project apportioning rate multiplied by relative weighted distance ~~of~~ from Walney 1&2

[3] Derived from the Project survey data (refer to paragraph 548 of the RIAA (~~APP-027~~REP1-012))

	The Project	Walney 1&2
[4] Breeding season apportioning rate multiplied by percentage of adult birds [5] Product of seasonal apportioning value and proportion of months. The seasonal values are summed to produce the annual weighted mean.		

~~3.1.2.2~~4.1.2.2 In-combination assessment update

~~29.~~91. The updated in-combination mortality estimates for lesser black-backed gull for Morecambe Bay and Duddon Estuary SPA are presented in **Table ~~4.2Table 4.2Table 3~~4.2**. The total annual in-combination mortality apportioned to the SPA is predicted to be 23 birds, which is equivalent to a 11.52% increase in background mortality. This compares to an increase of 8.40% predicted in the RIAA (~~APP-027~~REP1-012). The Project only contributes a very small proportion (0.33 birds; less than 1.5%) of the total predicted in-combination mortality.

~~30.~~92. As background mortality, based on the estimates presented above, would exceed 1%, a PVA for the in-combination estimation has been undertaken. This is presented in **Section ~~4.1.2.3~~4.1.2.3~~3~~4.1.2.3** below.

Table 4.2 Predicted in-combination annual collision mortality for breeding adult lesser black-backed gulls apportioned to Morecambe Bay and Duddon Estuary SPA. All values adjusted for avoidance rate of 0.9940 (SNCBs, August 2024)

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
Burbo Bank Extension	52.80	-	Awel y Mor	2.38%	1.26
Ormonde	26.52	-	Walney1&2	10.41%	2.76
Walney 1&2	68.64	-	Walney1&2	10.41%	7.14
Walney 3&4	35.15	-	Walney1&2	10.41%	3.66
West of Duddon Sands	62.88	-	Walney1&2	10.41%	6.54
Gwynt y Môr	7.20	-	Awel y Mor	2.38%	0.17
Rhyl Flats	0.69	-	Awel y Mor	2.38%	0.02
Robin Rigg	5.33	-	Morgan	7.80%	0.42
Awel y Môr	0.00	0.002	n/a	n/a	0.00
Erebus	8.08	-	Awel y Mor	2.38%	0.19
Twin Hub	3.28	-	White Cross	2.38%	0.08
Morgan Offshore Wind Project Generation Assets	0.97	-	n/a	7.80%	0.08
Mona Offshore Wind Project	1.89	-	n/a	7.67%	0.14
Burbo Bank	2.07	-	Awel y Mor	2.38%	0.05
West of Orkney	0.00	0	n/a		0.00

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
White Cross	0.40	-	n/a	2.38%	0.01
Sub-total excluding the Project	**275.89**	**-**	**-**	**-**	**22.52**
The Project	**3.57**	**0.33**	**-**	**-**	**0.33**
Total	**279.46**	**-**	**-**	**-**	**22.85**
Mortality increase[1]	**-**	**-**	**-**	**-**	**11.52%**

[1] Assuming an SPA breeding population of 1,724 adults and adult annual mortality of 0.115 = baseline mortality of 198 adult birds

~~3.1.2.3~~4.1.2.3 PVA update

~~31.~~93. The updated PVA predicts that the in-combination annual lesser black-backed gull collision impact from OWFs (23 individuals) would reduce the annual growth rate of the Morecambe Bay and Duddon Estuary SPA population (1,724) by 0.90%, and result in a 27.75% decrease in population size relative to the unimpacted population by the end of the 35-year model run. The PVA also predicts a negative growth rate for the SPA population of 0.9989 compared with 1.008 of the unimpacted population. This indicates a small population decline that is likely the result of in-combination collision mortality.

~~32.~~94. A summary of the PVA outputs is provided in **Table 4.3~~Table 4.3Table 34.3~~** for three scenarios – baseline (unimpacted), in-combination collision mortality including the Project, and in-combination collision mortality excluding the Project. This confirms that the Project alone would make a very small difference to the PVA, with the reduction in growth rate predicted to be 0.90% (compared to 0.89% if the Project was excluded) and reduction in population size at the end of the 35-year period of 27.75% (compared to 27.45%) for all in-combination projects excluding the Project. These differences are considered well within the bounds of natural variation and therefore indistinguishable from the all-projects scenario.

~~33.~~95. There are no changes to the conclusions of the RIAA as a result of this assessment update. As the Project would make no measurable contribution to the in-combination mortality, **it has been concluded that there would be no adverse effect on integrity to Morecambe Bay and Duddon Estuary SPA. Therefore, no conclusion in respect of in-combination effects for the Project is required.**

Table 4.3 In-combination Lesser black-backed gull PVA results for Morecambe Bay and Duddon Estuary SPA

Scenario	Predicted mortality	Median growth rate	Median CPGR	Median CPS	Reduction in growth rate	Reduction in population size
Baseline (unimpacted)	0	1.0080	1.000	1.000	N/A	N/A
In-combination collision mortality (including the Project)	22.85	0.9989	0.9910	0.7225	0.90%	27.75%
In-combination collision mortality (excluding the Project)	22.52	0.9989	0.9911	0.7255	0.89%	27.45%

~~3.1.3~~4.1.3 In-combination assessment update: Ribble and Alt Estuaries SPA

~~3.1.3.1~~4.1.3.1 In-combination assessment update

~~34.~~96. The updated in-combination mortality estimates for lesser black-backed gull for Ribble and Alt Estuaries SPA are presented in **Table 4.4~~Table 4.4~~Table ~~34.4~~**. The total annual in-combination mortality apportioned to the SPA is predicted to be 37 birds, which is equivalent to a 6.90% increase in background mortality. This compares to an increase of 3.86% predicted in the RIAA (~~APP-027~~REP1-012). The Project only contributes a very small proportion (0.69 birds; less than 2%) of the total predicted in-combination mortality.

~~35.~~97. As background mortality, based on the estimates presented above, would exceed 1%, a PVA for the in-combination estimation has been undertaken. This is presented in **Section ~~4.1.3.2~~4.1.3.2~~34.1.3.2~~** below.

Table 4.4 Predicted in-combination annual collision mortality for breeding adult lesser black-backed gulls apportioned to Ribble and Alt Estuaries SPA. All values adjusted for avoidance rate of 0.9940 (SNCBs, August 2024)

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
Burbo Bank Extension	52.80	-	Awel y Mor	3.94%	2.08
Ormonde	26.52	-	Morecambe	16.50%	4.38
Walney 1&2	68.64	-	Morecambe	16.50%	11.33
Walney 3&4	35.15	-	Morecambe	16.50%	5.80
West of Duddon Sands	62.88	-	Morecambe	16.50%	10.38
Gwynt y Môr	7.20	-	Awel y Mor	3.94%	0.28
Rhyl Flats	0.69	-	Awel y Mor	3.94%	0.03
Robin Rigg	5.33	-	Morgan	15.44%	0.82
Awel y Môr	0.00	0.05	n/a	n/a	0.05
Erebus	8.08	-	Awel y Mor	3.94%	0.32
Twin Hub	3.28	-	White Cross	3.94%	0.13
Morgan Offshore Wind Project Generation Assets	0.97	-	n/a	15.44%	0.15
Mona Offshore Wind Project	1.89	-	n/a	15.11%	0.29
Burbo Bank	2.07	-	Awel y Mor	3.94%	0.08
West of Orkney	0.00	0	n/a	-	0.00

Project	EIA mortality	HRA mortality	Proxy Apportioning	Annual apportioning rate	Annual Mortality
White Cross	0.40	-	n/a	5.19%	0.02
Sub-total excluding the Project	**275.89**	**-**	**-**	**-**	**36.13**
The Project	**3.57**	**-**	**-**	**-**	**0.69**
Total	**279.46**	**-**	**-**	**-**	**36.82**
Mortality increase[1]	**-**	**-**	**-**	**-**	**6.90%**
[1] Assuming an SPA breeding population of 4,638 adults and adult annual mortality of 0.115 = baseline mortality of 534 adult birds					

~~3.1.3.2~~4.1.3.2 PVA update

~~36.~~98. The updated PVA predicts that the in-combination annual lesser black-backed gull collision impact from OWFs (37 individuals) would reduce the annual growth rate of the Ribble and Alt Estuaries SPA population (4,638) by 0.54%, and result in a 17.83% decrease in population size relative to the unimpacted population by the end of the 35-year model run. However, the PVA also predicts a positive growth rate for the SPA population of 1.0026 compared with 1.0080 of the unimpacted population. This indicates a slowing of the population growth rate, rather than a population decline, is likely a result of in-combination collision mortality.

~~37.~~99. A summary of the PVA outputs is provided in **Table 4.5~~Table 4.5~~~~Table 34.5~~** for three scenarios – baseline (unimpacted), in-combination collision mortality including the Project, and in-combination collision mortality excluding the Project. This confirms that the Project alone would make a very small difference to the PVA, with the reduction in growth rate predicted to be 0.54% (compared to 0.53% if the Project was excluded) and reduction in population size at the end of the 35-year period of 17.83% (compared to 17.53% for all in-combination projects excluding the Project). These differences are considered well within the bounds of natural variation and therefore indistinguishable from the all-projects scenario.

~~38.~~100. There are no changes to the conclusions of the RIAA as a result of this assessment update. As the Project would make no measurable contribution to the in-combination mortality, **it has been concluded that there would be no adverse effect on integrity to Ribble and Alt Estuaries SPA. Therefore, no conclusion in respect of in-combination effects for the Project is required.**

Table 4.5 In-combination Lesser black-backed gull PVA results for Ribble and Alt Estuaries SPA

Scenario	Predicted mortality	Median growth rate	Median CPGR	Median CPS	Reduction in growth rate	Reduction in population size
Baseline (unimpacted)	0	1.0080	1.000	1.000	N/A	N/A
Cumulative collision mortality (including the Project)	36.82	1.0026	0.9946	0.8217	0.54%	17.83%
Cumulative collision mortality (excluding the Project)	36.13	1.0027	0.9947	0.8247	0.53%	17.53%

~~3.2~~4.2 Liverpool Bay SPA: Little gull

~~39.~~101. In its RRs (RR-061) NE commented *'Natural England cannot comment conclusively on the impact of the Project on little gull until NE Ref B11 regarding the sCRM methodology used for this species has been addressed'*.

~~40.~~102. In response to its comments, the Applicant has provided Natural England with the relevant input and output files for the little gull CRM, and also reviewed the cumulative assessment for this species at the EIA scale (refer to Section 3.2.2.4 of the Offshore Ornithology Updates (EIA context) Technical Note (Ref 9.26)). The cumulative assessment EIA update confirmed that for almost all projects no little gull mortality would be predicted, reflecting the low average density of this species across the Irish and Celtic Seas. For only one other windfarm project (Morgan Generation) was any measurable mortality identified, estimated by the Applicant (and noting that the Morgan Generation project did not present any mortality estimate for this species) at 0.59 birds annually. When combined with the predicted Project mortality of 2.92 birds, this would result in a total estimated annual mortality of 3.51 birds at an EIA scale.

~~41.~~103. As set out in the RIAA (~~APP-027~~REP1-012), there is uncertainty as to what proportion of little gulls present at the relevant project sites should be apportioned to the Liverpool Bay SPA population. The reasons for this are set out in paragraphs 506, 507 and 511 of the RIAA (~~APP-027~~REP1-012), but in summary:

- The SPA population (319 birds) is likely to be underestimated, and forms part of a much larger population of birds present within the Irish Sea and the wider North Atlantic which circulate through the SPA site during the winter and migratory periods (the total population of which may exceed 100,000 little gulls).
- Little gulls recorded within the project sites are likely to be additional to the SPA population count, although these may be birds that utilise the SPA as they circulate through the Irish Sea.
- The Project is located outside (adjacent to) the SPA, while the Morgan Generation project is located approximately 10km from the SPA boundary. On the basis of the above, it is considered reasonable to apportion few (or even zero) little gulls to the SPA population.

~~42.~~104. Notwithstanding this conclusion, if it is assumed that all of the birds present at the project sites (i.e. mortality of 3.51 birds combined from the Project and Morgan Generation project) are part of the Liverpool Bay SPA population, this would equate to an increase in background mortality of 5.50% (**Table ~~4.6Table 4.6Table 3~~4.6**). This compares to an estimate of 4.57% in the RIAA (~~APP-027~~REP1-012). Relating the collision estimate to the wider European winter population (which itself is likely to be underestimated) suggests an

increase in annual mortality of 0.17% (based on maximum European population estimate) to 0.31% (based on minimum European population estimate); see **Table 4.6~~Table 4.6Table 34.6~~**. This compares to estimates within the RIAA (~~APP-027~~REP1-012) of 0.14% and 0.26% respectively.

Table 4.6 Little gull – Predicted in-combination increase in annual baseline collision mortality

	Liverpool Bay SPA	EU winter population (min)[1]	EU winter population (max)[1]
Population size	319	5,700	10,200
Predicted annual background mortality (20.0%[2])	63.8	1,140	2,040
Predicted in-combination mortality (all birds apportioned)	3.51	3.51	3.51
% Increase in predicted mortality	5.50%	0.31%	0.17%

[1] 2013-18 population from 'Population status and trends at the EU and Member State levels' https://nature-art12.eionet.europa.eu/article12

[2] Based on adult mortality rate of 0.2000, noting that this is considered precautionary (NE and NRW, 2024)

~~43.~~105. Based on the above, the conclusions of the RIAA (~~APP-027~~REP1-012) are unchanged; i.e. **that there would be no adverse effect on the integrity of Liverpool Bay SPA, when considering the Project in-combination with other plans or projects.** This accords with the conclusions of the Round 4 offshore wind leasing HRA (NIRAS, 2021), which stated that '*for little gull the impact from the Round 4 Plan alone is considered to be negligible, and any additional impact from the Round 4 Plan alone would not make an appreciable difference to any in-combination impact*'.

45 Review of effect of air gap on lesser black-backed gull collision risk

4.15.1 Introduction

44.106. In its relevant representations (RR-061), Natural England stated *'The Applicant has committed to an air gap of 25m above HAT. However, their impacts on collision-sensitive species including from SPA colonies could be decreased further by increasing the air gap further. The Applicant should consider further increases to the air gap as a means of further mitigation.'* (RR-061-92).

45.107. In its response to the relevant representations (PD1-011), the Applicant stated that *'The Applicant made an increase to the air gap between PEIR and ES from 22m HAT to 25m HAT. The Applicant will present a review of the effects of further increasing air gap at Deadline 1. This will confirm that, as the contribution of the Project alone to in-combination mortality is so small, a further increase will make no measurable reduction to the change in background LBBG mortality. On that basis (and taking into account other constraints that limit the ability to increase air gap further), the Applicant considers that there is no justification to further increasing air gap.'* This section therefore presents an analysis of the effect of increasing air gap to support the Applicant's position. Lesser black-backed gull is considered by the Applicant most relevant as this is the only species vulnerable to collision for which Natural England has outstanding concerns as to whether adverse effect on integrity can be ruled out, in respect of Morecambe Bay and Duddon Estuary SPA and Ribble and Alt Estuaries SPA (refer to **Sections 2** and **4.14.134.1** above).

4.25.2 Approach

46.108. Collision risk modelling (CRM) for lesser black-backed gull has been undertaken using the stochastic CRM (sCRM) tool (McGregor, 2018), in accordance with the approach used for the ES Chapter 12 Offshore Ornithology (APP-049REP1-032). The model was run for air gaps of 25m (the current worst case scenario; Table 12.2 of ES Chapter 12 (APP-049REP1-032)), 28m and 30m above HAT (Highest Astronomical Tide). All other parameters used in the model were unchanged from those used for the DCO, with values presented using 'Option 2' of the sCRM tool, which assumes an even distribution of birds across the height of the rotors. Values have been estimated as follows:

- Estimated annual mortality as a result of the Project for each modelled air gap (equivalent to the information presented in ES Chapter 12

Offshore Ornithology (~~APP-049~~REP1-032)), and resultant increase in background mortality in relation to the largest seasonal BDMPS[1].

- Estimated mortality for the project alone apportioned to the two SPAs (equivalent to the information presented in the RIAA (~~APP-027~~REP1-012)).
- Estimated mortality for the two SPAs when considered in-combination with other projects, together with increase in background mortality for the adult SPA populations (based on the updated values presented in **Section ~~4.14.134.1~~** above).

~~4.3~~5.3 Results

~~47.~~109. The results of the comparison are presented in **Table 5.1~~Table 5.1Table 45.1~~**. The original sCRM input and output files are available on request.

Table 5.1 Summary of collision risk estimates for lesser black-backed gull for different air gaps above HAT (mean mortality, using Option 2 of the sCRM tool)

	Air gap	25m	28m	30m
EIA	Annual Mortality	3.57	3.00	2.76
	Increase in background mortality[1]	0.01%	0.01%	0.01%
Morecambe Bay and Duddon Estuary SPA	Annual Mortality (project alone)	0.33	0.28	0.26
	Annual Mortality (in-combination)	22.85	22.80	22.78
	Increase in background mortality[2]	11.52%	11.50%	11.49%
Ribble and Alt Estuaries SPA ~~**Ribble and Alt Estuaries SPA**~~	Annual Mortality (project alone)	0.69	0.59	0.55
	Annual Mortality (in-combination)	36.82	36.72	36.68
	Increase in background mortality[3]	6.90%	6.88%	6.88%

[1] Assumes a reference population of 240,750 and mean annual mortality rate of 0.1237 = 29,781 annual background mortality.

[2] Assumes an SPA breeding population of 1,724 adults and adult annual mortality of 0.115 = baseline mortality of 198 adult birds

[1] Breeding season BDMPS for UK Western Waters = 240,750 birds (Furness, 2015)

Air gap	25m	28m	30m
[3] Assumes an SPA breeding population of 4,638 adults and adult annual mortality of 0.115 = baseline mortality of 534 adult birds			

~~4.~~45.4 Conclusion

~~48.~~110. The results presented above confirm that increasing air gap above 25m would make a very small difference to the predicted mortality, particularly when considered for the in-combination values presented in **Section ~~4.14.13~~4.1~~.1~~**. For an air gap increase of 25m to 30m, this would result in a reduction of approximately 30% in predicted collision mortality for the project alone. However, as the number of impacted birds is small, this would result in a reduction in only 0.8 birds at the EIA scale. This would make no difference to the predicted change in background mortality (0.01% for all air gaps).

~~49.~~111. For the RIAA values, an increase in air gap would reduce the predicted mortality for both SPAs by only a fraction of one bird. When considered in-combination with other projects, the reduction in background mortality is very small (a maximum difference of 0.03% (from 11.52% to 11.49%) for Morecambe Bay and Duddon Estuary SPA for an increase of air gap from 25m to 30m). Such a change is likely to be undetectable at a population level, particularly when the uncertainties and level of precaution within the modelled estimates are taken into account. Therefore, the Applicant considers that a further increase in air gap would not be justified, as it would not provide measurable benefits.

~~5~~6 References

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Appendix 1: Lesser Black-backed Gull Breeding Season Apportioning

Table A1~~.1~~.6.1 Apportioning of lesser black-backed gull present in the Windfarm Site to coastal breeding colonies within mean maximum foraging range (127km; Woodward et al., 2019)

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Ribble and Alt Estuaries SPA	Yes	2023	4638	43.66	1906.20	2.743	1.1804	42.34%
Morecambe Bay and Duddon Estuary SPA	Yes	2023	1724	38.10	1451.61	2.550	0.5357	19.21%
Puffin Island SPA	No	2017	1052	61.04	3725.76	2.773	0.1385	4.97%
Anglesey Terns / Morwenoliaid Ynys Môn SPA	No	2023	280	79.73	6356.71	2.618	0.0204	0.73%
The Dee Estuary SPA	No	2013/2019	8	56.47	3188.97	2.931	0.0013	0.05%
Barrow-in-Furness	N/A	2010/2019/2022	2762	43.13	1860.54	2.572	0.6753	24.22%
South Solway	N/A	2009/2023	1436	117.88	13895.69	2.237	0.0409	1.47%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Haverigg and Millom	N/A	2013/2019	184	48.58	2359.53	2.555	0.0352	1.26%
Sellafield	N/A	2009	300	70.38	4953.06	2.518	0.0270	0.97%
Almorness Point	N/A	2021	746	117.81	13880.14	2.411	0.0229	0.82%
Askam-in-Furness	N/A	2019	84	50.32	2531.60	2.530	0.0148	0.53%
Heysham Power Station	N/A	2000	70	50.83	2583.99	2.509	0.0120	0.43%
Seaforth Nature Reserve and Liverpool City	N/A	1994/2019	66	57.82	3342.81	2.886	0.0101	0.36%
Manchester Ship Canal	N/A	2020/2022	100	80.91	6546.75	2.841	0.0077	0.28%
Maryport	N/A	2013	190	105.15	11056.10	2.387	0.0073	0.26%
South Island	N/A	1996/1999/2023	104	88.29	7794.59	2.833	0.0067	0.24%
Walney Urban Gulls	N/A	2019	22	39.65	1572.28	2.609	0.0065	0.23%
Whitehaven (Buildings)	N/A	2018	106	85.46	7303.75	2.483	0.0064	0.23%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Fleetwood	N/A	2019	18	39.18	1534.68	2.646	0.0055	0.20%
Thornton-Clevelys	N/A	1994	12	37.76	1426.04	2.679	0.0040	0.14%
Blackpool	N/A	2001	10	36.27	1315.51	2.712	0.0036	0.13%
East Island	N/A	1999/2017	34	70.80	5013.21	2.847	0.0034	0.12%
Workington	N/A	2009/2019	64	94.61	8950.67	2.435	0.0031	0.11%
Bangor and Caernarfon	N/A	2019	34	72.47	5252.19	2.620	0.0030	0.11%
North Island	N/A	1999/2017	42	86.60	7499.73	2.725	0.0027	0.10%
Rhoscolyn to Trearddur	N/A	2016	52	101.69	10341.47	2.532	0.0023	0.08%
Rhyl	N/A	2019	8	52.94	2802.11	2.952	0.0015	0.05%
Llanddulas Quarries	N/A	2002/2017	8	56.28	3167.21	2.902	0.0013	0.05%
Porth Llanlleiana to Porth Eilian	N/A	2016	12	67.77	4592.64	2.767	0.0013	0.05%
Point Lynas to Trwyn Du	N/A	2016	10	64.73	4189.97	2.763	0.0012	0.04%
Prestatyn	N/A	2019	6	51.99	2703.06	2.955	0.0012	0.04%
Ulverston	N/A	2013	6	55.99	3135.33	2.484	0.0008	0.03%
South Stack	N/A	2016/2022	14	93.85	8807.82	2.565	0.0007	0.03%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Fleet Bay	N/A	2018	16	121.80	14836.21	2.482	0.0005	0.02%
Carmel Head South	N/A	2001/2016	6	80.19	6429.95	2.696	0.0004	0.02%
Meikle Ross & Little Ross	N/A	2018	12	114.10	13019.27	2.483	0.0004	0.01%
Netherton	N/A	2019	2	52.80	2787.95	2.881	0.0004	0.01%
Kinmel Bay	N/A	2019	2	53.65	2878.32	2.947	0.0004	0.01%
Flimby and Risehow	N/A	2009/2019	8	102.17	10438.71	2.399	0.0003	0.01%
Morecambe	N/A	2000	2	55.61	3092.92	2.466	0.0003	0.01%
Bodorgan Head to Abermenai	N/A	2018	8	118.19	13969.11	2.512	0.0003	0.01%
Lillyhall	N/A	2019	4	95.98	9211.39	2.437	0.0002	0.01%
West Island	N/A	1998/2017	4	108.01	11665.51	2.811	0.0002	0.01%
Mull of Galloway	N/A	2015	4	126.97	16122.14	2.605	0.0001	0.00%
Llyn Dinam and Llyn Penrhyn	N/A	2019	2	97.84	9571.88	2.562	0.0001	0.00%

Master Site	Species is a Qualifying Feature?	Year of Colony Count	Colony Population	Distance to Development (km) (Centroid to Centroid)	Distance squared (km)	1/Proportion of Foraging Range as Sea	Resulting Weight	Proportional Weight
Port O'Warren	N/A	2020	2	119.50	14280.97	2.393	0.0001	0.00%
Siddick	N/A	2019	1	99.47	9893.29	2.418	0.0000	0.00%
Allonby	N/A	2013	0	113.52	12887.24	2.349	0.0000	0.00%
Beaumaris	N/A	2019	0	68.20	4651.51	2.711	0.0000	0.00%
Great Orme and Little Orme	N/A	2019	0	53.77	2890.89	2.877	0.0000	0.00%
Morecambe Bay	N/A	2019	0	64.75	4192.43	2.401	0.0000	0.00%
Rough Firth Merse	N/A	2020	0	121.92	14863.75	2.402	0.0000	0.00%
St Bees Head and Town	N/A	2020	0	77.92	6071.68	2.519	0.0000	0.00%
Totals	**-**	**-**	**14275**	**4064.50**	**350796.91**	**138.920**	**2.7882**	**-**

Appendix 2: PVA Input Parameters

Table A2-2-6.2 Lesser black-backed gull input parameters used in the in-combination PVA for Morecambe Bay and Duddon Estuary SPA

Parameter	Value
PVA model run type	simplescenarios
Model to use for environmental stochasticity	betagamma
Model for density dependence	No dd.
Include demographic stochasticity in the model?	Yes
Number of simulations	5000
Random seed	10
Years for burn-in	4
Case study selected	None
Species chosen to set initial values	Lesser black-backed gull
Age at first breeding	5
Upper constraint on productivity in the model?	Yes, constrained to 4 per pair
Number of sub-populations	1
Are demographic rates applied separately to each subpopulation?	No
Units for initial population size	Breeding Adults
Are baseline demographic rates specified separately for immatures?	Yes
Initial population values	1,724 in 2023
Productivity rate per pair	Mean 0.53, SD 0.325
Adult survival rate	Mean 0.885, SD 0.022
Immature survival rate – age class 0 to 1	Mean 0.798, SD 0.092
Immature survival rate – age class 1 to 2	Mean 0.885, SD 0.022
Immature survival rate – age class 2 to 3	Mean 0.885, SD 0.022
Immature survival rate – age class 3 to 4	Mean 0.885, SD 0.022
Immature survival rate – age class 4 to 5	Mean 0.885, SD 0.022
Number of impact scenarios	2
Are impacts applied separately to each subpopulation?	No
Are impacts of scenarios specified separately for immatures?	Yes
Are standard errors of impacts available?	No
Should random seeds be matched for impact scenarios?	Yes

Parameter	Value
Are impacts specified as relative value or absolute harvest?	Relative
Years in which impacts are assumed to begin and end	2028 to 2063
Scenario A: Including Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.012168
Impact on immature survival rate	None
Scenario B: Excluding Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.011977
Impact on immature survival rate	None
First year to include in outputs	2028
Final year to include in outputs	2063
How should outputs be produced, in terms of ages?	Breeding Adults

Table A2~~.3~~.6.3 Lesser black-backed gull input parameters used in the in-combination PVA for Ribble and Alt Estuaries SPA

Parameter	Value
PVA model run type	simplescenarios
Model to use for environmental stochasticity	betagamma
Model for density dependence	No dd.
Include demographic stochasticity in the model?	Yes
Number of simulations	5000
Random seed	10
Years for burn-in	4
Case study selected	None
Species chosen to set initial values	Lesser black-backed gull
Age at first breeding	5
Upper constraint on productivity in the model?	Yes, constrained to 4 per pair
Number of sub-populations	1
Are demographic rates applied separately to each subpopulation?	No
Units for initial population size	Breeding Adults

Parameter	Value
Are baseline demographic rates specified separately for immatures?	Yes
Initial population values	4,638 in 2023
Productivity rate per pair	Mean 0.53, SD 0.325
Adult survival rate	Mean 0.885, SD 0.022
Immature survival rate – age class 0 to 1	Mean 0.798, SD 0.092
Immature survival rate – age class 1 to 2	Mean 0.885, SD 0.022
Immature survival rate – age class 2 to 3	Mean 0.885, SD 0.022
Immature survival rate – age class 3 to 4	Mean 0.885, SD 0.022
Immature survival rate – age class 4 to 5	Mean 0.885, SD 0.022
Number of impact scenarios	2
Are impacts applied separately to each subpopulation?	No
Are impacts of scenarios specified separately for immatures?	Yes
Are standard errors of impacts available?	No
Should random seeds be matched for impact scenarios?	Yes
Are impacts specified as relative value or absolute harvest?	Relative
Years in which impacts are assumed to begin and end	2028 to 2063
Scenario A: Including Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.007208
Impact on immature survival rate	None
Scenario B: Excluding Morecambe	
Impact on productivity rate	None
Impact on adult survival rate	0.007060
Impact on immature survival rate	None
First year to include in outputs	2028
Final year to include in outputs	2063
How should outputs be produced, in terms of ages?	Breeding Adults